

a thermally conductive glue, which conducts heat from said die through said molding means to said heat-spreading device.

REMARKS

The present amendment is in response to the Office Action mailed September 25, 2002, in which Claims 1 through 12 and 19 through 26 were rejected. Applicants have thoroughly reviewed the outstanding Office Action including the Examiner's remarks and the reference cited therein. The following remarks are believed to be fully responsive to the Office Action and, when coupled with the amendments made herein, are believed to render all claims at issue patentably distinguishable over the cited references.

The specification and Claims 7 and 12 are amended herein. Claims 1 through 6, 10, and 13 through 24 are cancelled. New Claims 25 through 30 are added. Accordingly, Claims 7, 8, 9, 11, 12 and 25 through 30 remain pending.

All the changes are made for clarification and are based on the application and drawings as originally filed. It is respectfully submitted that no new matter is added.

Applicants respectfully request reconsideration in light of the above amendments and the following remarks.

CLAIM REJECTIONS – 35 U.S.C. SECTION 112, 2ND PARAGRAPH

With respect to Paragraphs 1 and 2 of the Office Action, the Examiner rejected Claims 1, 4, 7, 10, 21 and 24 under 35 U.S.C. Section 112, 2nd paragraph, as being indefinite. Specially, the Examiner stated that these

claims are rejected for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Applicants respectfully traverse this rejection.

Claims 1, 4, 10, 21 and 24 have been cancelled herein and Claim 7 has been amended for clarification to point out and distinctly claim the subject matter. Applicants respectfully submit that no new matter has been added by this change and further submits that the Examiner's rejection under 35 U.S.C. Section 112 is now overcome.

The Applicants disclose on page 6, lines 4 through 7, "*The substrate 20 includes a plurality of conductive traces (not shown), such as flexible printed circuits formed therein. The conductive traces of the substrate 20 are used to provide electrical conductive paths for signal transfer.*" The Applicants also disclose on page 6, lines 4 through 7, "*The conductive traces are on the substrate for providing electrical connective paths. One end of the bonding wire is connected to the chip 22 via a conductive pad formed thereon, the other end of the bonding wire 26 is connected to a solder ball of a BGA array 28 formed on the lower-sided surface (second major surface) of the substrate 20 via the conductive traces.*" The solder ball and bonding wire are connected by the conductive traces, such as flexible printed circuits. This feature of conductive traces is not shown in the figures.

Reconsideration and withdrawal of the rejection under 35 U.S.C. Section 112 are respectfully requested.

CLAIM REJECTIONS – 35 U.S.C. SECTION 102

With respect to Paragraphs 3 and 4 of the Office Action, the Examiner

rejected Claims 19, 20, 22, 23, 25 and 26 under 35 U.S.C. Section 102 (b) as being anticipated by U.S. Patent No. 6,206,997 to Egitto *et al.* (hereinafter referred to as "Egitto *et al.*"). Of the rejected claims, only Claim 19 is independent.

Applicants respectfully traverse this rejection on the grounds that it is now moot in view of the present amendment. Specifically, Applicants have cancelled Claims 19, 20, 22, 23, 25 and 26.

Reconsideration and withdrawal of the rejection under 35 U.S.C. Section 102 are respectfully requested.

CLAIM REJECTIONS – 35 U.S.C. SECTION 103

1. Claims 1, 2, 3, 5 and 6

With respect to Paragraphs 5 and 6 of the Office Action, the Examiner rejected Claims 1, 2, 3, 5 and 6 under 35 U.S.C. Section 103 (a) as being unpatentable over Egitto *et al.* Of the rejected claims, only Claim 1 is independent.

Applicants respectfully traverse this rejection on the grounds that it is now moot in view of the present amendment. Specifically, Applicants have cancelled Claims 1, 2, 3, 5 and 6.

Applicants respectfully request that the rejection of Claims 1, 2, 3, 5 and 6 under 35 U.S.C. Section 103 be reconsidered and withdrawn.

2. Claims 4 and 24

With respect to Paragraphs 5 and 7 of the Office Action, the Examiner rejected Claims 4 and 24 under 35 U.S.C. Section 103 (a) as being

unpatentable over Egitto *et al.* in view of U.S. Patent No. 5,609,315 to Lepore, Jr. (hereinafter referred to as "Lepore, Jr."). Neither Claim 4 nor Claim 24 is independent.

Applicants respectfully traverse this rejection on the grounds that it is now moot in view of the present amendment. Specifically, Applicants have cancelled Claims 4 and 24.

Applicants respectfully request that the rejection of Claims 4 and 24 under 35 U.S.C. Section 103 be reconsidered and withdrawn.

3. Claims 7, 8, 9, 11 and 12

With respect to Paragraph 8 of the Office Action, the Examiner rejected Claims 7, 8, 9, 11 and 12 under 35 U.S.C. Section 103 (a) as being unpatentable over U.S. Patent No. 6,146,921 to Barrow (hereinafter referred to as "Barrow"). Of the rejected claims, only Claim 7 is independent.

Applicants respectfully traverse these rejections.

When applying 35 U.S.C. Section 103, the claimed invention must be **considered as a whole.** (*Hodosh v. Block Drug Co., Inc.*, 786 F.2d 1136, 1143 n.5, 229 USPQ 182, 187 n.5 (Fed. Cir. 1986). (MPEP §2141))

The present application discloses a semiconductor package, a chip located on a substrate with signal transferring device electrically connected between them, solder balls connecting the substrate and thus electrically connecting the substrate to external circuits, a molding compound sealing and protecting the chip and the signal transferring means, the molding compound having geometrically a concave at the top surface of the center part, and a heat-slug capped over the molding compound through a conductive glue. All

area of the upper surface of the heat-slug is exposed to the ambient to improve the capability of spreading heat. The thickness of the molding compound on the center portion is thinner than on the periphery of the chip.

The molding compound between the chip and the heat-slug prevents the chip from rubbing against the bump of the heat-slug caused by the different thermal expansion coefficient.

Barrow disclosed an integrated circuit package, which includes a thermal element that extends into a cavity of an injection-molded housing. **The cavity exposes at least a portion of an integrated circuit** that is mounted to a substrate. The package includes an adhesive that attaches the thermal element to the housing and/or integrated circuit. The thermal element is assembled to the package after the housing has been molded onto the substrate and integrated circuit. Attaching the thermal element after the mold process can **insure that the element is in direct thermal contact with the integrated circuit.** Barrow emphasizes in column 1, lines 34 through 45, *"The plastic cures and becomes attached to the substrate, integrated circuit and heat slug. It has been found that the plastic material may flow between the heat slug and the integrated circuit to create a layer of plastic between the two components. **The plastic layer increases the thermal impedance between the integrated circuit and the heat slug.** The increase in thermal impedance may raise the junction temperatures of the integrated circuit. It would be desirable to provide a package and a process that would eliminate the formation of plastic between the thermal element and the integrated circuit."* Therefore, the integrated circuit rubbing against the thermal element caused by the different thermal expansion coefficient could not be avoided.

A prior art reference must be considered in its entirety, i.e., as a whole, including portions that would lead away from the claimed invention. *W.L. Gore & Associates, Inc. v. Garlock, Inc.*, 721 F.2d 1540, 220 USPQ 303 (Fed. Cir. 1983), *cert. denied*, 469 U.S. 851 (1984)

Although Barrow discloses a layer of plastic could be formed between the heat slug and the integrated circuit in the background information, but Barrow emphasizes that it is a disadvantage in packaging an integrated circuit. Barrow fails to teach a package structure with a cavity sealing the chip. Furthermore, Barrow discloses a package structure eliminating the formation of plastic between the thermal element and the integrated circuit. That which is disclosed by Barrow teaches away from the claimed invention.

Therefore, the novel features of Claim 7 of the present application produce new and unexpected results and hence are unobvious and patentable over these references.

Accordingly, Applicant respectfully submits that independent Claim 7 as amended is allowable over the art of record and respectfully requests the 35 U.S.C. Section 103 (a) rejection of Claim 7 be reconsidered and withdrawn. In addition, insofar as Claims 8, 9, 11 and 12 depend from independent Claim 7 and add further limitations thereto, the 35 U.S.C. Section 103 (a) rejection of these claims should be reconsideration and withdrawn as well.

Applicants respectfully request that the rejection of Claims 7, 8, 9, 11 and 12 under 35 U.S.C. Section 103 be reconsidered and withdrawn.

4. Claim 10

With respect to Paragraph 9 of the Office Action, the Examiner rejected Claim 10 under 35 U.S.C. Section 103 (a) as being unpatentable over Barrow in view of Lepore, Jr. Claim 10 is not independent.

Applicants respectfully traverse this rejection on the grounds that it is now moot in view of the present amendment. Specifically, Applicants have cancelled Claim 10.

Applicants respectfully request that the rejection of Claim 10 under 35 U.S.C. Section 103 be reconsidered and withdrawn.

MARKED-UP CHANGES

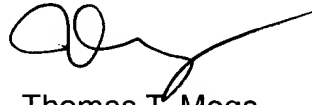
Attached hereto is a marked-up version of the changes made to the claims by the current amendment. The attached paper is captioned **"VERSION WITH MARKINGS TO SHOW CHANGES MADE."**

CONCLUSION

In light of the above amendments and remarks, Applicants respectfully submit that all pending Claims 7, 8, 9, 11, 12 and 25 through 30 as currently presented are in condition for allowance. If, for any reason, the Examiner disagrees, please call the undersigned attorney at 202-624-3947 in an effort to resolve any matter still outstanding *before* issuing another action. The undersigned attorney is confident that any issue which might remain can readily be worked out by telephone.

Favorable reconsideration is respectfully requested.

Respectfully submitted,

A handwritten signature in black ink, consisting of a stylized 'T' and 'M' followed by a long horizontal stroke.

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Dated: **November 22, 2002**

TTM/hs

VERSION WITH MARKINGS TO SHOW CHANGES MADE
(USSN 09/746,018)

IN THE SPECIFICATION:

The paragraph at lines 14 through 19 of page 6 has been amended as follows:

One end of the bonding wire is connected to the chip 22 via a conductive pad formed thereon, the other end of the bonding wire 26 is connected to a solder ball of a BGA array 28 formed on the lower-sided surface (second major surface) of the substrate 20 via the conductive traces.

IN THE CLAIMS:

Claims 1 through 6, 10, and 13 through 24 have been cancelled without prejudice and without dedication or abandonment of the subject matter thereof.

Claims 7 and 12 have been amended and new Claims 25 through 30 have been added as follows:

7. (Amended) A semiconductor package, comprising:
- a substrate;
 - a die located and supported on said substrate with an adhesive layer between them;
 - a plurality of signal transferring means which electrically connects said die to said substrate;
 - a molding compound which seals and protect said die and said plurality of signal transferring means, wherein said molding compound has geometrically

a concave at the top surface of the center part ; and

a heat-spreading device which is attached atop said molding compound to conduct heat from said die to ambient air, wherein said head spreading device has a downward bump aligned to said concave; and

a plurality of conductive means attached below said substrate to electrically connect a plurality of conductive traces on said substrate to external circuits.

12. (Amended) The semiconductor package of claim 7, wherein said die has a thermally conductive glue, which conduct heat from said die through said molding compound to said heat-spreading device.

25. (New) A semiconductor package, at least comprising:

molding means, with a concave located at the central part of the top surface, for sealing and protecting a die, which is adhered on a substrate by an adhesive layer and electrically connected to the substrate by a plurality of signal transferring means; and

heat-spreading means for conducting heat from said die to ambient air by attaching atop said molding means , wherein said head spreading means has a downward bump aligned to said concave.

26. (New) The semiconductor package of claim 25 further comprises a plurality of conductive means attached below said substrate to electrically connect a plurality of conductive traces on said substrate to external circuits.

27. (New) The semiconductor package of claim 26, wherein said plurality of conductive means includes a plurality of solder balls.

28. (New) The semiconductor package of claim 25, wherein said plurality of signal transferring means can be a plurality of bonding wires.

29. (New) The semiconductor package of claim 25, wherein said heat-spreading means can be made of metal.

30. (New) The semiconductor package of claim 25, wherein said die has a thermally conductive glue, which conducts heat from said die through said molding means to said heat-spreading device.